NATIONAL CRISIS MANAGEMENT

AND

TECHNOLOGY

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NWC Class of 1989

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
1989	**N/A**	**-**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
National Crisis Management and Technology	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **National Defense University National War College Fort McNair, Washington, DC 20319**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**UU**	**64**	

OUTLINE

1.0 INTRODUCTION

Research relevant to the forecasting of intranational and international security crises has proceeded in four significant areas. First, basic research regarding the sources and decision-making process of crises has proliferated since the early sixties.[1] Second, interdisciplinary research regarding the development and use of quantitative variables and indicators has also progressed rapidly in the last decade.[2] Third, during this same period, the art of forecasting has convincingly evolved into a credible science;[3] and finally, the development of computerized techniques for the storage, retrieval, processing, and display of data has dramatically improved. However, there have been very few attempts to integrate these areas into a coherent concept which would allow the development, test, and implementation of a national crisis warning and management system.

1.1 Overview of the Problem

U.S. security priorities in the immediate and longer range will revolve around U.S. interests and goals in a dramatically changing global environment. This environment is and will be characterized by ideological conflict, resource and energy scarcities, population expansion and maldistribution, increased nuclear proliferation and arms trade, heightened nationalism and terrorism, and unstable trade and monetary conditions.

As a result of the predominant position which the U.S. occupies in the global environment and the depth of its global participation, these and

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1 C. A. McClelland, "The Acute International Crisis," 1961

2 H. L. Calhoun, H. M. Weil, and D. Krysakowski, Political and Military Activity Levels: A Comparison Using Quantitative Indicators, 1974. Nazli Choucri and Thomas Robinson, Forecasting in International Relations, 1978

3 D. B. Bobrow and J. Schwartz, eds., Computers and the Policy-Making Community, 1969

other conditions will inevitably give rise to problems with which the U.S. must deal. Some of these problems will evolve into crises where U.S. interests and goals will be threatened and the necessity for timely response will be magnified. Since the U.S. is likely to be confronted with international security crises of all natures, it is imperative that procedures for anticipating, managing, and averting them continue to be developed, evaluated, and improved.

In an effort to respond to these international problems and crises, the U.S. has devoted attention to the development of methods to enhance its overall crisis warning and management capabilities. Currently, responsibility for the analysis of crisis for the purpose of forecasting, averting, and managing future crises is spread across a number of Governmental offices and agencies, including the Department of State, Central Intelligence Agency, the Treasury Department, the National Security Agency, the White House, and the Department of Defense. Such groups have devoted special attention to crisis forecasting in general and, understandably, to the development of techniques for nuclear crisis forecasting in particular. A large portion of this work has revolved around the identification and observation of crisis indicators which, in the beginning, were qualitatively identified and observed. More recently, however, progress has been made in the use of quantitative indicators, most notably in the identification and observation of military activities and capabilities.[4]

Unfortunately, while the use of military and some intelligence indicators has progressed from qualitative to the quantitative stage, the same cannot be said of the use of nonmilitary ones. Specifically, political and economic indicators have not received adequate quantitative attention and are therefore unable to contribute significantly to the national security community's ability to forecast crises. This lack of quantitative indicators for other than military activities has led to a number of crises which have caught the U.S. Government by surprise.

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[4] Referring to technical collections systems which discretely observe equipment and personnel movements in quantitative terms.

Another set of quantitative indicators which has also received far too little attention are those which would provide insight into the nature and depth of U.S. national interests abroad. How, for example, can a decision-maker assess the importance of an impending event without some hard estimates of his "stake" in the affair?

Yet another area which merits special attention in crises research, is the identification of useful quantitative indicators. Research to date has made only brief reference to precisely how international activities should be observed, that is, how you can identify and evaluate the method or methods likely to yield the most useful indicators for warning.

Further, there is very little work which has been done on how such indicators and methods might be integrated into a user-oriented interactive crisis warning system. Specifically, too little attention has been devoted to the design of integrated crisis warning systems and to the development of computer hardware and software necessary for the rapid and efficient storage, retrieval, processing, and display of the information vital to national crisis forecasting.

1.2 Overview of a Proposed Solution

In order to develop a national crisis warning system, a number of steps must be taken. First, the number and nature of useful quantitative indicators for crisis warning must be established. Indicators of U.S. national interests should also be identified and examined. Most importantly, ranked regional and country-by-country lists of U.S. national interests should be generated and used in conjunction with indicators for crisis warning.

The range of useful forecasting methods should also be determined. Methods within such a range should be tested, compared, and ranked according to their forecasting potency. Finally, all of these steps should lead to the design, construction, and installation of a user-oriented crisis warning system.

Comprehensive applied research directly related to the warning of intranational and international security crises is thus extremely sparse. In order to rectify the situation, it is necessary to develop coherent analytical strategies. Fortunately, there exist a number of approaches and methods for such purposes.[5] These approaches and methods constitute a solid research base from which more sophisticated techniques for practical crisis warning might be developed.

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[5] C. F. Hermann, International Crises: Insights from Behavioral Research, 1972

2.0 INTERNATIONAL CRISES

During the last 35 years, there have been a significant number of crises in which the United States has been involved. A good deal of research has been done and a general set of conclusions has been drawn upon the nature of these crises. Normally, four broad categories have been used in the analysis: 1. indications and warnings, 2. general crises description and categories, 3. National security involvement, and 4. a profile of the U.S. responses to these crises.

2.1 What We Have Learned in International Crises

In 43% of the crises the environment was tense prior to the onset of the crisis itself. However, in 57% of the cases activity was routine or just a slight increase in tension was noted prior to the onset of the crisis. The duration of the precrisis activity exceeded 30 days 48% of the time with 32% of crises providing no warning at all using current methods of monitoring. Only 38% of all crises were anticipated prior to their onset. The reasons for this are varied but it has been determined that a failure to identify the events leading to a crisis and an unwillingness for crises managers to believe that the events would culminate in a crisis are the most prominent reasons for not anticipating a crisis. While plans have been developed to handle crises in various parts of the world, it was found that few of these plans were appropriate for the actual crisis or for that matter were even reviewed for use. In 46% of the crises the threat which precipitated the culmination of the crisis surfaced in less than seven days before the onset of the crisis.

In describing what a "generalized" crisis would look like, you can anticipate that 89% will be international in nature as compared to 11% which would be domestic. The crisis itself would be political in nature only 8% of the time, with 33% of the crises only military. Fifty-nine percent of the crises would be both political and military. The location of the crisis would be: 25% of the time in East Asia and the Pacific area,

18% in Central and South Africa, 17% in Western Europe or the Mediterranean, and 15% of the time in South Asia and sub-Saharan Africa.

The duration of the crisis would be 30 days or longer in nearly 60% of the cases. The time available to make a decision which could affect the outcome of the crisis required a prompt response in 58% of the cases.

There were severe threats to U.S. national security interests in 25% of the crises with no significant threat in 24% of the cases. In 51% of the crises, there was some threat to U.S. interests.

Research done on over 100 crises in the last 35 years has shown that three quarters of the time the U.S. objectives were to reestablish the status quo. The nature of U.S. responses to these crises has included direct involvement of U.S. personnel in 37% of the cases and direct national confrontation with another nation 34% of the time. Military and political assistance were provided in 15% of the situations with no involvement only 10% of the time.

The resolution of the crises exceeded 30 days 61% of the time with resolution occurring in seven days or less in 23% of the events. U.S. interests were advanced 41% of the time and reduced 40% of the time.

The process of making decisions on necessary crisis response and the requirement to coordinate actions among Government agencies often create delays. This has proven to be the case despite the need for a quick response. One major delaying factor has often been the Presidential decision-making process. Despite the fact that Presidential approval for action has only been legally required in 12% of the crises, the President was involved in 78% of the crises. The need to consider security issues and constraints placed on military actions has also hampered the decision process. The impact of crises options on domestic and international politics has dramatically increased and has been commensurate with the increase in media coverage. Inadequate and delayed intelligence has also been a problem in the decision process.

During the last decade, six significant trends have developed in the management of crises by the United States. The crises situations have developed slowly, but the actual crises occurred suddenly. Several crises management problems arose when U.S. military personnel became involved after the situation had severely deteriorated. Problems involving information handling, indications, and warnings continue to increase. In over one third of the cases, a crisis developed as the United States was monitoring another crisis. More frequent problems involving force status, training, availability, and disposition have also been observed. Force readiness was a problem in half the cases with a lack of secure communications hampering efforts in 40% of the cases. The crisis response by the U.S. Government has slowed as more emphasis has been put on inter-agency coordination. Domestic and international political considerations are becoming more predominant and are constraining U.S. Government responses.

2.2 Problems in Crisis Management

The predominant problems affecting crisis management have involved difficulties in crisis prediction and timing. General problems in crisis handling include initiation of timely, appropriate, and adequate response; systematic and procedural constraints on proposed actions; and delays in decision-making because of requirements for interagency or intergovernmental coordination. In a study sponsored by the Defense Advanced Research Projects Agency (DARPA), crisis problems were identified in 18 categories and rank ordered.

1. Problems in crisis timing.
2. System/procedural constraints on actions.
3. Problems in crisis handling.
4. System-related delays in decision-making/action.
5. Constraints on operations.
6. Problems in operating environment.
7. Problems in crisis planning.
8. Emotional/ideological issues involved.
9. Interpersonal factors in decision making.

10. Force status problems.
11. Intelligence failures at decision-making level.
12. Failures in taking appropriate/timely action.
13. Problems in selecting action personnel.
14. Legal issues involved.
15. Resources inadequate for decision-making/action.
16. Information failures by operating forces.
17. Prolonged crisis problems (human factors).
18. Physiological problems for operating forces.

The study concluded that the sensitivity of crisis managers to these problems continues to push these managers to more dependence on advanced command, control, and communications (C^3) systems. In such a time-dependent and uncertain environment, coupled with rapid growth of information on world events, crisis handling, of necessity, must rely on technological aids. The study further concludes that the frequent occurrence of time-sensitive crisis management problems necessitates rapid development of advanced C^3 aids to support future crises managers.

3.0 WARNING INDICATORS

3.1 Data Sets

Until the late 1960's foreign policy analysis by researchers was generally done in isolation and they confined themselves to case studies or non-systematic observations of "foreign policy." Then a new field emerged in foreign policy research led by Dr. Charles McClelland described in his book "Conflict Patterns in the Interactions Among Nations." From that time on the event emerged as the basic unit of analysis, thus ending the previously awkward method of using empirical inquiries into the response to foreign policy behaviors abroad and relating these responses to subsequent behavior.

3.2 Event Data

Events are defined as "The acts initiated by national governments on behalf of their societies, and pursued beyond their national boundaries, to effect changes in the behavior of other nations-states and international actors in the international system." There are a number of salient features within this definition. First, the emphasis on acts means that events refer to behavior, to the things states do and say to others. However, events do not measure national goals, national interests, or the content of national policy orientation. Second, events refer to foreign policy actions that are official and governmental, that is, external behavior which is a direct result of governmental action. For the purpose of most event collections, the actors, or initiators of events are usually the official representatives of sovereign states.

Third, because they are extracted from public sources, events are, by definition, newsworthy. Since news sources are interested, normally, in reporting out-of-the-ordinary activities, events are empirical references of nonroutine foreign policy behaviors of states. Consequently, researchers assume, as did McClelland,[6] that changes in event activity are indicators

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[6] Parker, Crisis Forecasting and Crisis; McClelland, "Acute International Crisis," 1969.

of dramatic interactions between states, and are generally not measures of routine behavior, or transactions, between states.

Fourth, by the nature of events, we may infer an underlying motivation behind the initiation of those events; to influence the behavior of other actors in the international system. Therefore, for the most part, what the press monitors and deems newsworthy are the attempts of one state to affect the behavior of another state to the advantage of the former. In 1972 Coplin and O'Leary concluded, in Everyman's Prince, that international events are expressly "influence attempts" designed for the explicit purpose of getting others to do what they would otherwise not do. If foreign policy events are, as indicated, politically motivated, then you can assume that foreign policy activities indicated by events are goal-oriented, purposeful forms of behavior. Foreign policy acts can therefore, be seen as deliberate activities undertaken consciously to achieve state goals on a rational basis. While events and interactions are indicative of actions taken to achieve specific objectives, it cannot be concluded that international foreign policy strategies can be gleaned from just studying event data. In fact, events tend to be tactical moves designed to achieve strategic (grand strategy) national objectives.

3.3 Event Data Abstraction

A critical aspect of using event data as source information for developing a crisis warning system necessitates the development of systematic and consistent procedures for storing, manipulating, and quantifying event data. Explicit coding rules must be devised, outlining the operations performed in converting textual accounts of activities into quantified data. Research often mentioned in laying out these coding rules include P.J. McGowans' 1970 book "The Unit-of-Analysis Problem in the Comparative Study of Foreign Policy." His coding technique requires the data collector to condense the account into the most discrete, meaningful printed statement about foreign policy that can be identified. Ordinarily, the event is abstracted so that it can be recorded in a "who (nation) did

what (action) to whom (nation)" format. Thus, the coding operation takes data from foreign policy activity, because the actions in these declarative sentences identify foreign policy acts.

A popularly cited example of an operational data base of foreign policy events is the World Event/Ineraticior survey.[7] The event coding scheme employed recognizes 63 kinds of events in 21 broad categories. The data base includes ~100,000 events coded from the New York Times. The basic coding elements include the type of event observed as well as the time of its observation. Actors and targets constitute the remaining two elements. In a very real sense, then, the coding elements provide information regarding who (actor) does what (event) to whom (target) and when (time).

3.4 Problems in Using Event Data

While events data is not in and of itself a panacea in comparative foreign policy analysis, through the understanding of the activities and the assumptions used to gleam the data, an information system can be developed to support crisis management personnel. Besides, at least for the last 15 years, it has been the best and most reliable overall source for performing foreign policy research and analyzing national security activities. There are six major problems associated with using events data to analyze or research inter-state behavior.[8]

1. Definitional characteristics of an event: how are events to be conceptualized and identified?

2. Codification procedures: what are the scientific requirements of a systematic coding scheme, and what are the consequences of alternate coding procedures?

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[7] C. A. McClelland, B. Fitzsimmons, G. Hoggart, W. Martin, World Event/ Interaction Survey Handbook and Codebook, 1969.

[8] C. Kegley, G. Raymond, R. Rood, and R. Skinner, International Events and the Comparative Analysis of Foreign Policy, 1975.

3. The question of measurement: should events be measured simply by categorizing types, or be scaled to distinguish intensities of events?

4. Source coverage considerations: which public sources should be coded, and how many different sources are adequate?

5. Event data validity: to what extent do international events constitute a meaningful operational measure or indicator of interstate behavior?

6. Event data reliability: to what extent is the data reproducible?

3.5 Results of Event Data Research

There are enormous inequalities between nations with respect to the number of events initiated by a given nation. At one extreme, Switzerland averaged fewer than two and one-half events per month; whereas the United States initiated an overage of sixty-two. The number of events is statistically relevant to the size and development of the nation involved:

Eleven large countries initiated 594 events/year.
Twenty-four small countries initiated 212 events/year.
Nineteen developed countries initiated 418 events/year.
Sixteen underdeveloped countries initiated 229 events/year.

Ninety percent of all events had only one other nation as the target of the event. Sixty percent of all events also had indirect targets. In other words, the initiating nation normally addressed the event to a single nation but sought to influence another nation at the same time. Sixty-five percent of all events were undertaken by two or more governments (joint initiative) with the nation division: large 53%, small 80%, developed 61%; underdeveloped 74%. As you might expect, smaller and less developed countries are more inclined to collaborate to add authority to their actions. For all countries 39% of the direct targets and 71% of indirect

targets were other governments. Six percent of the direct targets, and less than 1% of indirect targets were domestic entities within the targeted country. The percentage of direct and indirect targets that consisted of political parties or officials of international organizations were 55% and 29% respectively. Large countries targeted other nations government (48%) more often than small countries (27%). Small less developed countries were much more likely to target alliances and international organizations than their larger counterparts.

Of 11,617 events analyzed in the Comparative Research on the Events of Nation project, it was determined that few actions involve threats and promises (513), military force (825), or restrictions on sovereignty (358). There is a clear tendency in studying international crises to concentrate on what are considered critical issues--such as political crisis, military engagements or trade agreements--to the exclusion of the majority of international events actually taking place.

3.6 Event Theory: A Systematic Approach to Analysis

The main characteristic of the systematic approach to crisis analysis is the use of words and deeds occurring in the crisis. It is the "external behaviors" of the parties in the conflict that are given full attention. The focus is on the flow of actions and responses of the crisis participants.

Very important from the standpoint of identifying the early signs of a real crises has been the fluctuations in the number and types of events of the contesting parties. While research has shown that the underlying motivations of the contestants appear to have remained constant (i.e., their grand strategy), the actions to attain these goals have varied greatly across time.

The best way to approach and monitor change is to look into the frequency and type of interactions between contestants within a specific time period(s). While the sheer volume of actions has served to be a

reasonably good indicator of a developing crisis a more appropriate method is a combination of the number of events and the types (categories). The segregation of events into categories and the volume of events in these categories can be determined and used to establish a set of "normal" event activities for a nation. Twenty-one categories of events have been identified for this purpose: yield, comment, consult, approve, promise, grant, reward, agree, propose, reject, accuse, protest, deny, demand, warn, threaten, demonstrate, reduce relationship, expel, seize, and force. From this point, events can be categorized and collected for as long a period of time as possible. Once the empirical data is collected, norms can be established, over time, and the interrelationship between the number and type of events can be determined.

In research performed by Charles McClelland, it has been determined that the changes from the norm (i.e., normal activity) has served as a reliable leading indicator of a forthcoming crisis. The mechanism used compared the historical norms against current events on a percentage basis and plotted changes over time. Then he analyzed previous crises and determined that when variations reached a certain threshold, that a crisis was underway or forthcoming. Therefore, a system which tracked these changes in event trends could be used as an early warning crisis indicator system. However, difficulties remained in analyzing and determining the meaning of the events/actions of the nations.

3.7 Stages and States of a Crisis

In the process of defining event relationships, a critical activity is the determination of changes in a crisis. A crisis can be broken into four phases: normal activity, pre-crisis, crisis, and abatement. The uptrend stage of a crisis, pre-crisis, should be a change in state of events as should the transition through crisis into the abatement stage. Research in this areas has shown that changes in a crisis can be demonstrated by a change in the type and number of events.

In analyzing the four stages of a crisis, C. McClelland determined that five behavioral "states" existed and that the 21 categories of events data could be aligned within these states. Through the analysis of the change in the number and categories of events within these states, the stages of the crisis could be determined. With this research in hand, a crisis can be monitored and the cause and effect relationship of policy initiatives on changing the stage of crisis determined.

The states of a crisis and the event categories are as follows: 1) conflict deeds - encompassing demonstrate, reduce relationship, expel, seize, and force; 2) confrontation - encompassing reject, accuse, protest, deny, demand, warn, and threaten; 3) attempts to settle - include approve, consult, promise, request, and propose; 4) settlement - include yield, grant, reward, and agree; and 5) expression - which convey information and state positions and intentions which includes the category of comment. The results of these studies indicate conflict deeds increased slightly in the pre-crisis phase and decreased more strongly in the abatement phase. Also, in the downward phase, conflict deeds are fewer than in normal stage. Events that fall within the attempt to settle categories increase rapidly as the turning point from crisis to abatement is reached. Additionally, confrontation events increased as the abatement phase was entered. As the abatement phase is entered, the settlement events increase and peak as the normal activity levels are once again reached. Through the monitoring of the change of the trends in these behavior categories, turning points can be identified and the results of political actions monitored (see Bibliography #14).

4.0 PROTOTYPE NATIONAL CRISIS MANAGEMENT SYSTEM REQUIREMENTS

It has become evident from my readings on research performed to date that existing systems, procedures, and mechanisms used to identify, monitor, and support the management of international crises is inadequate. This problem has been compounded by the dramatic increase in both news coverage and international communications. The future holds a continual increase in the flow and timeliness of international event information as communications systems and access to these systems become more routine.

The national crisis manager must, to stay abreast of evolving events, be provided new tools if he is to be expected to perform the critical responsibilities assigned him.

4.1 System Requirements

First and foremost is the development of a system capable of handling vast quantities of textual information. As part of this function automation must be used to not only maintain accountability of the data but in near real time analyze the input and provide the user a condensed version of chronological events, the meaning of these events, as well as identifying the possibility of a crisis. As a part of the analysis function, a standard or norm must be developed, against which event activities can be compared. this will provide the norm, against which activity changes can be measured and will provide the foundation of the Crises Alerting System. While the trend in event research has been towards quantification of these activities to provide the basis for analysis, I would argue that direct event-oriented processing will provide the next major advance in developing future crises warning/management systems.

The development and validation of crisis indicators will serve as the norm against which evolving international events can be compared. These indications will be numerous and should encompass both qualitative and quantitative characteristics to mitigate the weaknesses inherent in using one approach unilaterally over the other (i.e., provide trend information

as well as the interpretation of the meaning). The indicators themselves must be an integral part of the system, whose main purpose is to extract relevant activities from an environment which is very dynamic and provide timely notification. Additionally, the indicators themselves must be "accepted standards" for measurement so that when a potentially evolving crisis is identified, the user will have sufficient confidence, as will his superiors, that a crisis is in fact developing, i.e., he believes the warning. This will allow the crisis manager to initiate action more expeditiously than has occurred in the past.

However, delays in decision making, inappropriate procedures, and inter/intra-agency coordination delays have adversely affected our ability to respond expeditiously, even in the most critical crisis, these problems are outside the scope of this research project but are nevertheless critical to improving the process.

The system must be capable of handling, sorting, analyzing, storing, searching, and displaying information with only limited user intervention. The user interface must be simple yet provide a great deal of flexibility. Since the user will be a substantive country/regional expert, the system must allow the monitoring of ongoing crises, ability to develop ad hoc queries for information, and monitor other potential crises simultaneously (alerting system). Numerous other functions such as word processing, electronic mail, and other basic office automation features must also be readily available. The dynamic nature of international behavior necessitates that the analyst also be able to change the sort/search/ pattern-matching parameters of incoming traffic as well as searching the data base for additional information.

The requirements strongly suggest that the system be totally integrated and a distributed network developed to allow direct interaction of national crisis managers as well as the integration, albeit partitioned and secure, of other crisis centers.

The expected data volume of such a system clearly points to the need for a highly responsive system which will be compute and I/O intense. The necessity of a secure operating environment is obvious as is the need for high reliability and graceful degradation. Such a system would be able to forecast both short and longer term activities which have proven to be indications of increased international tension and have precipitated past crises. There must be both quantitative and qualitative measurements and a determination of certainty provided which the analyst can use to further pursue areas of increasing tension. The system must not only identify adverse actions but provide the analyst an explanation of the reason that certain events can culminate in a crisis. The system should also provide recommendations or additional data searches to further refine the information needed by the analyst and point him to other events or activities which bear on the crises, essentially leading an analyst through a structural thought process which will allow him to explore all the possibilities in as expeditious and efficient manner as possible. Also, this will provide him the necessary background and information necessary to persuade his superiors that a problem is developing. The intent is to create a proactive environment as opposed to reactive.

The system must be able to interpret the meaning of information as well as automatically distributing high interest information to the appropriate user. The information should either be condensed or have high interest items highlighted to allow the rapid scanning of vast amounts of data with only negligible compromise of the facts.

5.0 FORECASTING

5.1 Forecasting Methods

The first step in the development of a method(s) upon which a crisis warning system can be developed is to review the implications of different forecasting methodologies. This is particularly important as you move to automated analysis of event-oriented information which has historically been done by trained analysts prior to providing utility to crisis managers. Therefore, this departure from traditional methods must be borne in well-understood precepts and allow for practical verification.

At the most general level of abstraction, one can distinguish among forecasting methods in terms of the degree of explicit theory, the use of systematic procedures, the use of empirical data, and the purpose of the forecast. Ranging from the least to the most systematic, alternative forecasting methods include (1) normative forecasts, (2) exploratory projections, (3) methods employing formal models, (4) simulation methodologies, and (5) artificial intelligence. The more precise the methodology is, the greater are the probabilities of obtaining valid forecasts, but at the same time, the greater are the forecasters input into the forecasting design. When reducing uncertainty itself involves working with uncertainty, such as event and intent oriented data, precision becomes a liability not an asset.

Normative forecasts tend towards the use of "should" rather than "is." They are based on implicit theory, little or no use of formalized methods, and almost no use of systematically collected data. Such forecasts tend towards undisciplined speculation and the lack of formalized procedures precludes the systematic and consistent data collection necessary to improve reliable forecasts. Normative forecasting methods are used to identify conditions which lead to desired outcomes rather than systematic analysis of intervening processes/events.

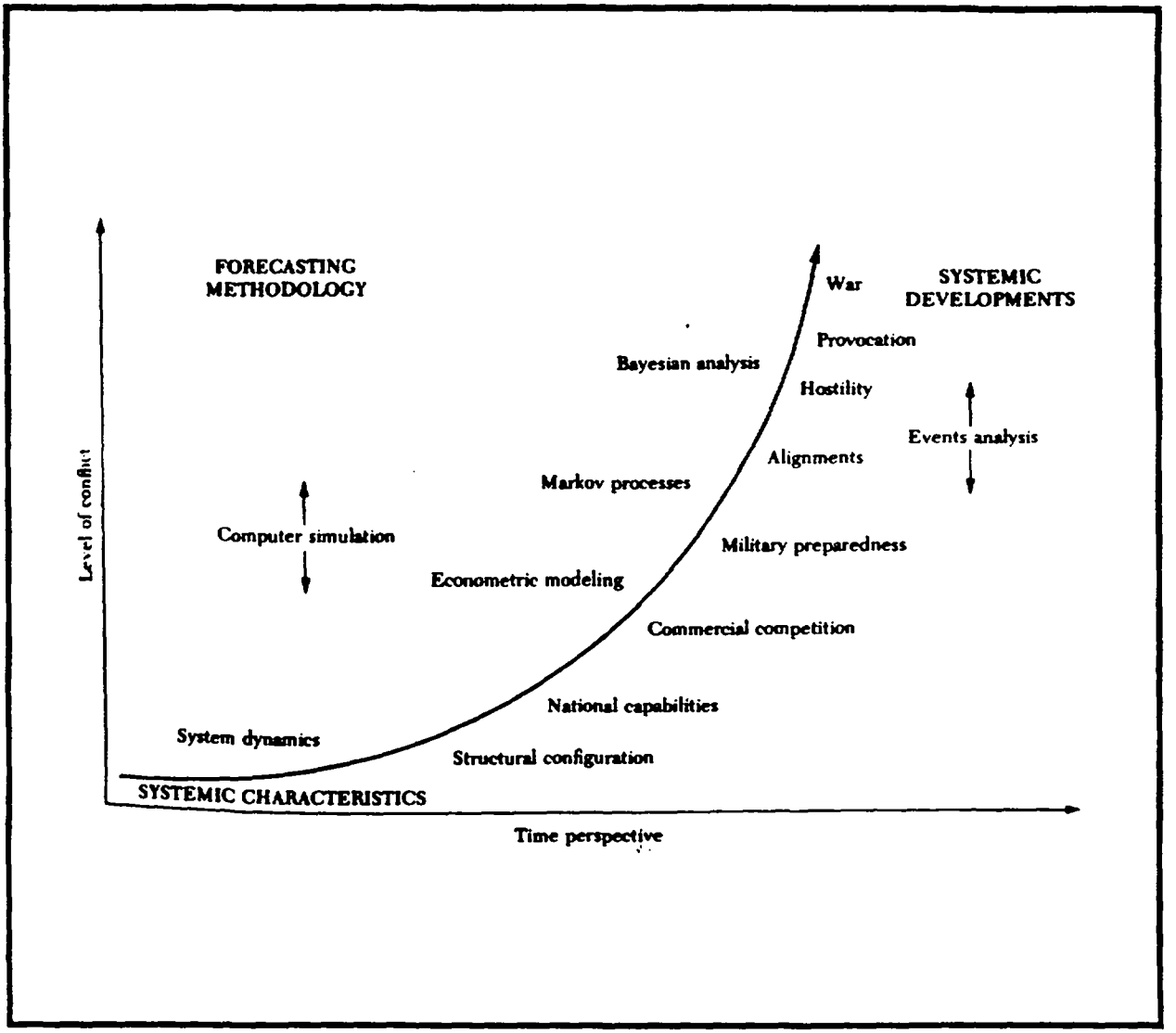
More systematic forecasting methods include exploratory projections, trend extrapolations, or heuristic forecasts. Such forecasting methodsrepresent a step in the direction of a more systematic methodology which lends itself to improved reliability. However, they are most appropriate for forecasting conditions that do not change or change very slowly. Demographic trends, ecological factors and international transactions such as trade, business factors and the like, can be forecast with these methods. But microfactors such as events which are dynamic in nature or international factors with their inherent interrelationships and changing cause and effect relations cannot be satisfactorily depicted or established with trend projections or exploratory forecasts (see Figure 1).

The use of methodologies predicated upon explicit use of formal models such as descriptive, explanatory, or predictive models represent a significant step in providing precision and reliability to dynamic quantified data. Such models may be statistical or functional, based on parameter selection (event(s)) rather than estimation and lends itself to the use of empirical data. Each model alerts the forecaster to different aspects of reality.

Statistical models can be based on explicit theory, formal methods and empirical data, and if properly developed, can provide cause and effect relationships supporting event-oriented indicators. Decision analysis (Bayesian statistics) confronts the unknown directly rather than through inference based on conventional probability distribution but does require a prior specification of the structure of the problem. This would not lend itself to a dynamic and changing environment required for this application.

Simulation analysis for forecasting purposes is often a sophisticated and complex approach to uncertainty analysis. There are many modes of simulation and they all involve some explicit use of theory, some formality and systematic procedures for drawing inferences about the nature and behavior of relationships. Simulations in which crisis decision-makers participate have provided considerable in-roads into the decision process.

FIGURE 1. INTEGRATING FORECASTING METHODOLOGIES: AN ILLUSTRATION FROM CONFLICT ANALYSIS



However, all-computer simulations are most appropriate for highly analytical approaches to the unknown but by their very nature they are abstract from reality. Unfortunately, the erratic often governs outcomes of international realities. The newest methods of systematic analysis is artificial intelligence, a mode of all-computer simulation developed for the analysis of adaptive behavior and learning as well as change. So far, almost no attempts at employing artificial intelligence in the forecasting mode have been made. This area is the most probable area for future advancements in analysis and forecasting. One of the most significant and proven strengths of AI is its ability to handle uncertainty.

5.2 Forecast Conditions

In practice the selection of a forecasting method will to a large extent be dependent on what is possible, or the likely, as opposed to the desirable. For in the long run, a forecasting system or method that cannot meet the test of reliability and consistency will fall into quick disuse. There are three conditions which are critical to the development of a crisis warning model. First the selection and structure of the attributes which provide the foundation for the data base must be well understood as must the behavioral relationship between the attributes. In international relations, such structural factors include demographic and ecological conditions, resource profiles and flows, national state and international relations and military relations to the government and events surrounding changing conditions. Second, a forecast should have normative values which provide a basis for measuring short and long-term deviation and thus allow for distribution measurement from the mean. Lastly, trends and projections of event factor(s) both singularly and on an aggregate basis, as appropriate, allow measurement of variations within normative values and flagging of variants beyond defined distribution norms.

5.3 Short-Term Forecasting Model

A forecast aimed at planning, policy, and expectations, shorter term, will focus primarily upon manipulative variables that can be controlled by

the crisis manager and/or his staff. A forecast that aims to gain insights into the structure of international systems in the future will focus primarily upon aggregate structural conditions that are more stable over the long run and therefore not readily amenable to manipulation.

Since, in the first case, the emphasis is upon short-term forecasting and the second long-term, the methodologies and requirements of the forecast will be different, the variable of time can serve as the essential parameter around which appropriate model(s) can be identified. An analysis of the past, through the rise of various models, provides a relationship of the relevance of certain models to events over time (see Figure 1).

For the short-term, retrospective models such as decision analysis, Markov processes, or event analysis provide the most appropriate techniques. The availability of vast amounts of historical data provides a sound basis for identifying and categorizing variations which can be used as early warning indicators. Further, the extrapolation of trends can be useful in identifying future potential problem areas. Another paramount advantage to retrospective models is the ability to validate the model against historic occurrences. This allows for the refinement of the model(s) and development of confidence in its reliability and determination of the degree of uncertainty. Of equal importance is an understanding of the weaknesses of the model.

The Markov models emphasize the depiction of changes over the short range and associates probabilities of transition from one stage of conflict to another. The use of decision analysis (Bayesian) provides the reduction of uncertainty associated with decision making and takes into consideration of idiosyncratic factors of decision makers.

Another approach to short range forecasting, events analysis, enables the forecaster to develop reliable early warning systems that generate signals of future events before they happen. If you develop reliable parameters/measurements which can be normative in nature and relate these to events in a systematic and formal process, then a useful system can be

defined, retrospectively tested, and after refinement, implemented.[9] This approach coupled with AI to support semantic event interaction and understanding coupled with the inherent abilities of AI to handle uncertainty seems to be the best approach for this application.

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9 E. E. Azar, Analysis of International Events, 1970

6.0 CRISIS INDICATOR SYSTEM, CONCEPT

6.1 Introduction

In conventional software we tell the computer how to solve the problem through the use of various statements, conventions, and algorithms. This is generally done in an environment where we are asking the computer to solve the problem. Ordinarily the computer is given data and a step-by-step program that specifies how the data is to be used to reach an answer. Normal software applications are based on set(s) of algorithms which are converted into a computer program, a sequential list of instructions or commands that tell the computer exactly what operation to carry out.

Artificial intelligence (AI) on the other hand is not based on an algorithmic process. Instead, it is based on symbolic representation and manipulation. In AI a symbol is a letter, word, or number that is used to represent objects, processes, and their relationships. Objects can be people, things, ideas, concepts, events, or statements of facts. By using symbols, it is possible to create a knowledge base that states facts, concepts, and the relationship between them. The process itself is qualitative rather than quantitative as is in the algorithmic process.

The fundamental way an AI application works starts with the establishment of a knowledge base consisting of facts and a description of the logical associations of, in this instance, event data. From this a mechanism (i.e., inference engine) is implemented to manipulate the facts and infer conclusions. The techniques used to perform this manipulation are search and pattern matching. Given the knowledge base, the AI software searches these facts and identifies specific conditions or patterns. The computer literally hunts around until it finds the best answer it can based on the knowledge it has.

6.2 Why Artificial Intelligence?

During the research I performed in the field of international crisis management, I found that the main thrust of the analysis done to support

the development of a mechanism to warn of impending crisis was based on figuring how to make event data statistically relevant so that conventional algorithms could be used to "identify the problem."[10] It has been proven time and time again that non-numerical problems often don't yield to algorithmic processes and those that do are often found wanting. I would suggest the latter is the case in this instance. Further, problems with uncertainty and ambiguity have proven to be overwhelming challenges for algorithmic applications. However, these are the very areas where AI applications have proven their value. With algorithm software, the problem is guaranteed to be solved, with AI, there can be partial solutions or even no solution. As a result, AI often fits the disorganized, imperfect real world better than conventional software because it can deal with shades of gray.

The major use of AI today is in expert systems. AI programs that act as intelligent advisors or consultants. Drawing on stored knowledge in a specific domain (i.e., region, country, country-country relations), a user applies inferencing capability to tap the knowledge base. As a result, almost anyone can identify and/or solve problems and make decisions in a subject area nearly as well as an expert. The purpose of an expert system is not to replace the experts, but simply to make their knowledge and experience more widely available. When you think of the amount of knowledge, experience, and expertise that is necessary to handle international crises and to identify potential problem areas before they become crises, the use of expert systems seems an appropriate mechanism.

6.3 Structuring the AI Application

An expert system consists of three major components: a knowledge base, an inference engine, and a user interface. The knowledge base contains all the facts, ideas, relationships, and interactions of a

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10 M. K. O'Leary and W. Coplin, Quantitative Techniques in Foreign Policy Analysis Forecasting, NY, 1975. P. I. deSola, "Alternatives in Social Science Forecasting." In Forecasting in International Relations; Theory, Methods, Problems, and Prospects, S.F. 1977.

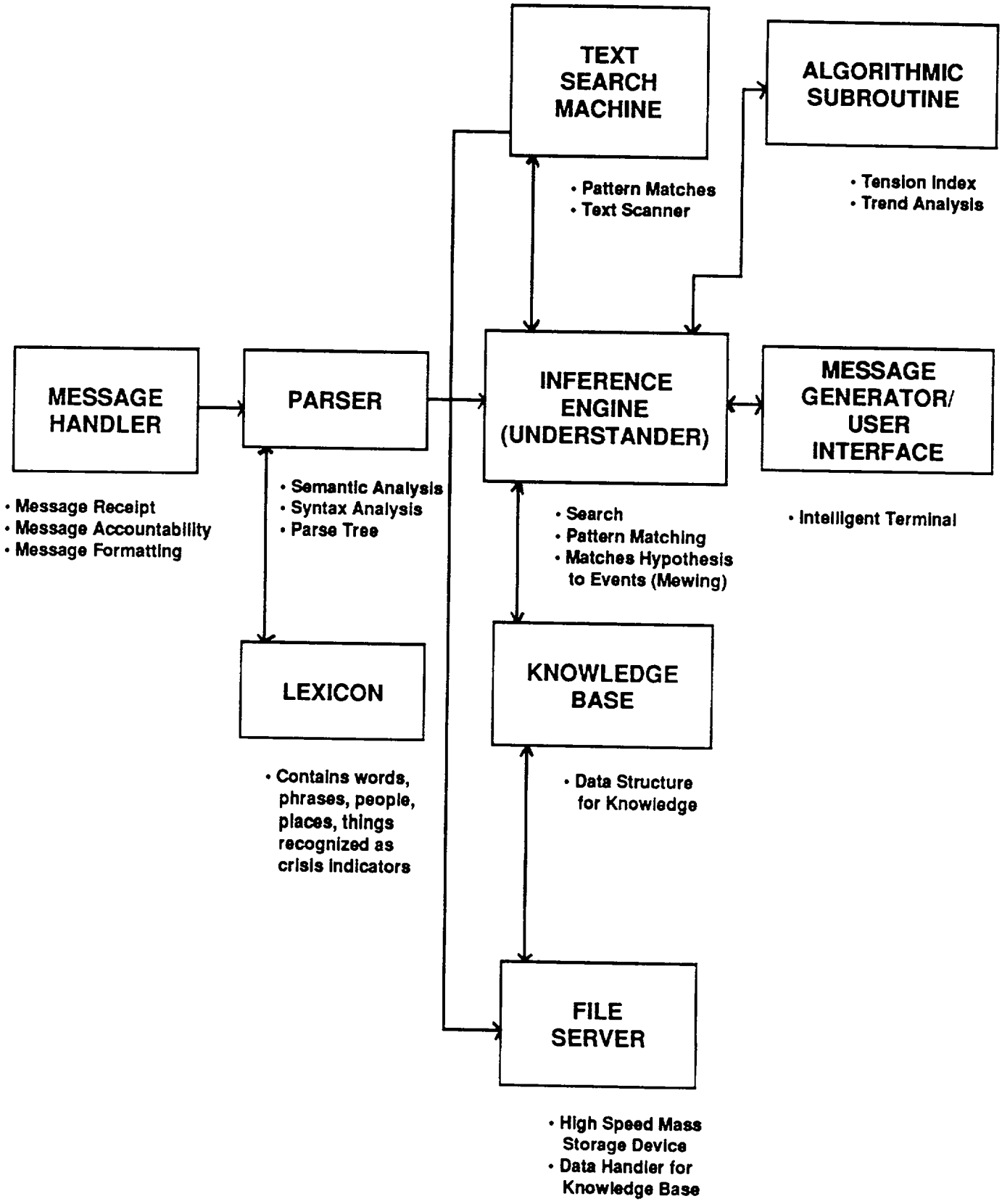
domain. The inference engine analyzes the knowledge and draws conclusions from it. The user interface software permits new knowledge to be entered into the knowledge base and implements communications with the user. Also, if properly designed, allows a user to easily request new searches for information, thereby providing a great deal of flexibility.

6.3.1 Prototype Concept. In today's information age data overload provides new challenges to the crises manager. It has often been noted that there is so much data as a result of high speed international communications that the identification of a precipitating crisis is often lost in the volume of information. This problem requires that knowledge be gleaned from the data and be presented to the analyst.

This prototype system would use a message handler which would receive incoming data, assure accountability of the information, and hand the messages to a natural language processing (NLP) program which would perform semantic and syntax analysis; i.e., determine the meaning of the data. The NLP would consist of five functions: parser, lexicon, understander, knowledge base, and generator (see Figure 2, Process Flow). The first function will be the parsing of the input data. The parser is a piece of software that analyzes the syntax of the information. The result of this process is the development of a parse tree which identifies the noun, verbs, and adjectives and is the first step in determining the meaning of the data. The parser works very closely with the lexicon which contains all the words and phrases which the parser recognizes in performing syntatic analysis. For example, the parser would take a sentence from a message and access the lexicon to determine the nouns, verbs, and adjectives of the sentence (i.e., who, what, when, where). If a match was found, then the parser would highlight that portion of the message as being relevant to determine the meaning of the message. It would then pass it to the understander for semantic determination. The parser essentially gleans relevant data for further analysis.

6.3.2 Understander (Inference Engine). The inference engine is software that implements a search and pattern-matching operation. The inference

FIGURE 2. PROCESS FLOW



engine consists of rules which are used to perform search and pattern matching routines which when matched with information in the knowledge base result in of three actions: 1. initiates additional search or other meaning interpretation routines; 2. initiates output which is the interpretation or meaning of the international activity; or 3. finds no match. The rules are developed through intensive interviews with "country experts" who have in-depth knowledge of a particular country/region. The rule sets would consist of military, political, and economic factors which will be used to determine if there was a change in the crisis condition of a country and who or what was causing that change. Table 1 contains a systematic listing of contemporary international crises events[11] which would, in conjunction with country/regional experts, be used to establish "IF AND THEN" statements for use in the inference engine. This approach provides a systematic basis for compiling uniform rule sets from expert foreign service officers using events which have been found to be indicators of crises. With the rules established, the inference engine would then look through the knowledge base to find a match between the rule and the available events, which are contained in the knowledge base. Since the inference engine is a compilation of 306 conditions which have been shown to be indicators of crises, the pattern-matching process is simply one of taking known crises indicators and looking for a match of those patterns in the current events which are stored in the knowledge base.

6.3.3 Knowledge Base. The knowledge base contains facts about objects, in this case events, in the domain (country/region) and their relationship(s). The knowledge base forms the system's source of intelligence and will be used by the inference mechanism to reason and draw conclusions. Knowledge representation schemes are generally categorized as either declarative or procedural. A declarative scheme is one used to represent facts and assertions. A procedure representation scheme deals with actions or procedures.

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11 C. F. Hermann, Substantive Problem Area Coding Manual. Mershon Center, Ohio State University, 1974

TABLE 1. Inference Engine, Areas
For Crisis Identification

(1) Domestic use of military force against own nationals or other military activities within their own country

01 = riot/demonstration/strike control
02 = defense of key governmental officials and installations
03 = counterinsurgency
04 = coup d'etat
05 = civic action projects

(2) Nonwar use of military force applied to (directed toward) foreigners (i.e., people not members of the country which military serves)

01 = military occupation of foreign territory
02 = demonstrations or shows of force
03 = military assistance or training
04 = foreign bases, installations, rights of military personnel abroad
05 = overflight or port of call privileges
06 = prisoners of war, espionage agents, spies, imprisonment of foreigners

(3) War and large-scale combat actions (includes military assistance during war)

01 = civil war
02 = border war

(4) Isolated military incidents (noncontinuous actions involving military force outside of the country of at least one party whose military units are engaged)

01 = guerrilla raids
02 = air strikes
03 = naval encounters
04 = border encounters
05 = military treaty or agreement violations
06 = espionage or spying on by military units or activities

(5) Conflict negotiations or military settlement

01 = cease-fires/peace agreements/surrender arrangements
02 = prisoner, spy negotiations or exchanges
03 = peacekeeping forces
04 = boundary or border determinations/negotiations
05 = international organization resolutions concerning cessation of violence or means of peacekeeping

(6) Arms control and disarmament

01 = strategic nuclear weapons
02 = proliferation of nuclear weapons
03 = chemical/biological weapons
04 = conventional arms
05 = complete or general disarmament
06 = inspection and verification

(7) Military alliances (all aspects other than actual engagement in combat)

01 = alliance formation, membership changes, conditions for joint action
02 = alliance financing
03 = control and organizational aspects
04 = military needs
05 = negotiation between alliances

(8) Nonalliance force maintenance and preparedness

01 = manpower, draft, recruitment
02 = financing
03 = adequacy of existing weapons
04 = concealment of military activities, maneuvers, weapons deployments

(9) Verbal threats, doctrines, and general activities (primarily verbal) pertaining to use of force

01 = military warnings, threat to use force, ultimatum
02 = deterrence strategy
03 = pledges, guarantees of military protection and support
04 = subversion or ideological advocacy with possible overtones of resort to force

(10) Domestic violence (confined to one country with vast majority of participants being nationals of country in which conflict occurs)

01 = domestic-oriented violent riots, strikes, protect demonstrations
02 = intergroup violence--conflict between religions, tribes, racial groups
03 = terrorism/kidnapping/hijacking/bombing/sabotage--attacks on victims chosen more or less at random or because of their representation of some broader class
04 = antigovernment violence--armed rebellion, coups and attempted coups, revolution, assassination, guerrilla warfare
05 = hostility to foreigners within country--attacks on occupying troops, foreign officials, foreign nongovernmental visitors, colonial administrators

(11) External violence (primarily participants in violence acting outside their own country)

01 = foreign terrorist activities
02 = participation in foreign wars--individuals or groups on their own joint and/or lead combat activities in wars in which their own country is nor formally involved
03 = foreign private organizations engage or support violent actions--business firms, ethnic organizations pay for or promote violence outside their country of origin

(12) Substantive categories of commerce, industry, and international trade

01 = arms
02 = automobiles and other road vehicles
03 = coal and coke
04 = grains
05 = fish or other sea products
06 = oil, gas, and petroleum
07 = iron ore
08 = precious metals and stones
09 = textiles
10 = fertilizers
11 = complete facilities or plants
12 = electronic parts and equipment
13 = uranium and other radioactive elements
14 = other natural resources
15 = other agricultural products
16 = other manufactured goods

(13) Trade agreements and associations between international entities

01 = common markets, custom unions
02 = preferential trading agreements, "most favored nation" status
03 = cartels of producer governments
04 = cartels of consumer governments
05 = arrangements between consumers and producers of a given commodity

(14) Fiscal or monetary arrangements proposed or existing between two or more international actors

01 = international banks, credit arrangements, international fiscal assistance agencies
02 = currency arrangements--means of fixing relative value of currencies; mechanisms for revaluation

(15) Financial conditions of one entity

01 = budget deficits, shortage of working capital
02 = taxation problems
03 = unfavorable balance of payments

(16) Regulations and protective actions

01 = nationalization of privately owned businesses
02 = export licenses
03 = embargoes
04 = import tariffs and duties
05 = import quotas
06 = subsidies to domestic products
07 = fishing rights

(17) Economic assistance to other entities

01 = loans, credits
02 = sales or purchases
03 = aid or grants
04 = dues or contributions to organizations or collective efforts

(18) Business firms owned by and/or operated primarily within one nation

01 = foreign sales
02 = governmental control and regulation
03 = investment activities of
04 = productivity
05 = domestic marketing and price activities
06 = labor issues
07 = financial condition

(19) Multinational corporations--business firms owned by and/or operated to a substantial degree in two or more countries

01 = relations with national governments
02 = effects on market and commodity price
03 = investment activities of
04 = productivity
05 = labor issues
06 = financial condition

(20) Interest groups and associations (organizations of persons having shared interest in some economic activity cooperating to promote their interests through lobbying, promotional activities, and direct political and economic action)

01 = trade unions
02 = agricultural associations
03 = manufacturing and commercial associations
04 = humanitarian and service groups

(21) Activities of individuals or loose, temporary collections of individuals

01 = private investors
02 = consumer activity--temporary boycotts, protests, demonstrations
03 = workers activity--"wildcat" strikes, demonstrations, absenteeism
04 = violation of fishing limits

(22) Banks and related financial institutions

01 = lending rates; loan policies
02 = international activities of
03 = relations with government
04 = assets and investors

(23) General condition of society's economy

01 = existence and rate of inflation
02 = existence or possibility of recession or depression
03 = difficulties in fulfilling economic plans and goals
04 = rate and direction of all goods and services produced

(24) Natural resource problems (difficulties pertaining to the natural resources found in the society or under its control)

01 = nonexistence or depletion of natural resources
02 = lack of development of natural resources
03 = ability to control price, rate of consumption, and consumers

(25) Agricultural problems

01 = excessive dependency on single crop
02 = ownership of arable land and collectivization problems
03 = crop failures
04 = market difficulties
05 = shortages of agricultural materials

(26) Labor problems

01 = shortage of skilled labor
02 = high unemployment
03 = labor/management disputes; exploitation
04 = foreign labor or aliens, migrant workers

(27) Industrial problems

01 = foreign ownership or control
02 = shortage of capital
03 = lack of modernization; uncompetitive
04 = shortages or reduced quality of nonlabor or semifinished materials
05 = market difficulties

(28) Transportation and distribution problems

01 = difficulties in railroad system
02 = difficulties in merchant marine
03 = difficulties in air transportation
04 = difficulties in highway/trucking system

(29) Acknowledgement (at least tacitly) of errors (or inadequacies under present conditions) in past policy, statements, or activities (including yielding under political or military pressure) or inability to fulfill policies and goals; admission that one has been wrong

01 = diplomatic apology
02 = provide material compensation, restoration, reparations
03 = agree to compromise settlement or to seek settlement on less than original terms; make concessions
04 = admit political corruption
05 = grant colony or subnational territory greater autonomy or independence
06 = surrender to other existing entities all or part of territory and/or population
07 = yield selective sovereignty by granting existing entities rights or privileges on own territory or control over citizens under certain conditions
08 = concede inability to reach agreement with other entities or to correct or gain adequate redress from wrong doing by another entity

(30) Engaging in termination or violation of some existing agreement or activity presently engaged in

01 = break off or can negotiations, talks, visits
02 = violate, cancel, reduce, or modify treat or formal agreement
03 = break, reduce, or temporarily disrupt diplomatic relations
04 = expel diplomats or other official representatives or abuse or violate diplomatic protocol
05 = withdraw from alliance, union, federation, common market
06 = terminate or reduce assistance or contribution--financial, technical, military, etc.
07 = default on payment for goods or services, repayment of loans, etc.
08 = expel private citizens from own country

(31) Repudiating or rejecting some entity or its plans, policies, or actions

01 = verbally denounce or protest action, statement or plans, form of government, ideology, leaders, etc., of another entity(ies)
02 = refuse to accept communication or receive diplomat or other representative
03 = reject proposal, plan, request, or offer including votes against resolution favored by deprived entity
04 = oppose or reject entity for membership or affiliation with organization, alliance, etc.
05 = refuse visas for citizens of deprived country or deny or complicate their immigration into entity creating deprivation
06 = deny colonies or other subnational regions independence or greater autonomy

(32) Advancing proposal, resolution, or request that could create embarrassment, create an unfavorable political situation, or otherwise create problem for recipient

01 = seek new or expanded financial or other assistance
02 = propose collaboration on specific mutual projects
03 = establish or expand treaty or agreement or organization
04 = create or expand treaty or agreement or organization
05 = admit entity to an existing organization or upgrade its present affiliation
06 = form permanent organization, alliance, or consultative agreement
07 = joint initiative or position vis-a-vis third parties
08 = suggest state visit or other travel

(33) Need for diplomatic and political communication with other nations (participatory actions designed to maintain exchanges and contracts between nations and which, in and of themselves, are not reported as involving specific substantive topics, includes actions designed to avoid further problems by failure to follow expected norms)

01 = state visits, international ceremonies
02 = joint communiques
03 = general statements of praise or acknowledgement
04 = annual or interim reports in an international organization designed to summarize past behavior and activities

(34) Opposition to actions and/or policies

01 = verbally denounce or repudiate deprived entity(ies)
02 = physical demonstrations, protests against deprived entity(ies)
03 = prohibit or expel membership or participation in organization or put on "probation"
04 = withhold benefits--goods, services, convention sites, etc.

(35) Misconduct, impropriety, or accidents by individuals or groups creates an "incident" and possible (real or potential) shame to country with which they are affiliated

01 = tourists
02 = businesses or corporations
03 = missionaries or religious representatives
04 = fugitives, criminals, terrorists
05 = students, educators, cultural exchange personnel
06 = crashes, wrecks, accidents

(36) Challenges and/or defeats in competition

01 = sports
02 = scientific endeavors, technological feats
03 = business sales
04 = trade fairs, exhibits
05 = cultural and artistic achievements

(37) Widespread public rejection of actual or proposed international commitment or those individuals widely associated with that commitment (or election of those opposed to it)

01 = defeat in national referendum, election, or other voting occasion
02 = results of poll or survey indicating widespread opposition or dissatisfaction
03 = campaigns, rallies, marches in opposition to external activity or commitment

(38) Existence or potential emergence of conditions which reduce entity's standing vis-a-vis other nation or other international actors

01 = domestic economic conditions
02 = domestic political instability
03 = domestic social problems
04 = domestic health conditions

(39) Constraints on political and legal well being

01 = abolish or impose limitations on political parties or opposition groups
02 = abolish or suspend constitution of laws; "emergency powers"
03 = alteration or abuse of judicial procedures
04 = restrict opportunities for individual political participation (e.g., voting, holding office, advocating political preferences)
05 = unlawful seizure of government, overthrow, dismissal, or elimination of "legal" officeholders
06 = unlawful arrest or incarceration or "disappearance"
07 = governmental corruption, scandal, acceptance of bribes

(40) Constraints on economic well being

01 = abuse of taxation power
02 = limitations on employment opportunities or promotion
03 = inadequate protection against life's accidents or "disrupting experiences" (e.g., governmental insurance for unemployment, disability, retirement)
04 = governmental economic mismanagement , bankruptcy, economic fraud, regulation of inflation, depression
05 = arrangements or mismanagement between governments causing economic hardships; balance of payments deficit; revaluation of currency

(41) Constraints on health care

01 = regulation affecting access to or quality of medical service
02 = adequacy of pollution control and protection of environment
03 = involvement in population problems, birth control, abortion, family planning

(42) Constraints on travel and mobility

01 = imposition of curfews
02 = restrictions on domestic travel
03 = adequacy of public transportation system
04 = complicate process for travel; refuse immigration of citizens who desire to leave country
05 = restrictions on temporary visits across borders

(43) Constraints on shelter and housing

01 = adequacy and availability of living units
02 = restrictions on ownership

(44) Constraints on religious beliefs and practices

01 = prohibitions on certain religions, religious movements and organizations
02 = restrictions on public expression of certain religious beliefs or practices

(45) Constraints on criminal activities and treatment of criminals

01 = adequacy of police protection
02 = treatment of prisoners and nature of punishment
03 = drug abuse and traffic in drugs and narcotics

(46) Constraints on minorities or subgroups; discrimination

01 = racial discrimination
02 = ethnic or nationality discrimination
03 = sex-based discrimination

(47) Damage to victims of war

01 = civil war
02 = border war
03 = isolated terrorist attacks
04 = sieges, embargoes, blockades
05 = world wars

(48) Engaging in criminal acts

01 = crimes by legal corporations
02 = crimes by "organized crime syndicates"
03 = crimes by political parties and politically motivated groups
04 = acts of violence against humans by other than corporations, syndicates, or political parties
05 = destruction or theft of property by other than corporations, syndicates, or political parties
06 = monetary or financial crimes by other than corporations, syndicates, or political parties

(49) Nongovernmental discrimination against minority or subgroup

01 = racial discrimination against minority or subgroup
02 = ethnic or nationality discrimination
03 = sex-based discrimination

(50) Private withholding or withdrawal of service and/or assistance

01 = failure to provide financial grants, loans, gifts, etc.
02 = strikes, work slowdowns, massive absenteeism
03 = boycotts, blacklists, etc.

(51) Existence of hunger, malnutrition, famine

01 = attributable primarily to crop failure
02 = attributable primarily to drought
03 = attributable primarily to chronic imbalance between population and agricultural production
04 = attributable primarily to inequality in distribution of food stuffs

(52) Existence of poverty; inadequate resources to provide the necessities of life--food, shelter, clothing

01 = urban slums; squalor
02 = society-wide poverty associated with nation's low level of economic development

(53) Existence of disease; epidemics

01 = malaria
02 = typhoid
03 = smallpox
04 = tuberculosis
05 = viral influenza
06 = cholera

(54) Natural disasters

01 = hurricane, tornado, cyclone, typhoon
02 = flood
03 = earthquake
04 = fire
05 = drought
06 = insect and crop, feed and animal diseases
07 = volcanoes
08 = radioactive fallout

(55) Censorship or discrediting of foreign information (information may be either about foreign events or about domestic events reported by foreigners)

01 = foreign journalists censored

02 = prohibit internal distribution of information from foreign sources
03 = restriction on citizens from disseminating their work abroad
04 = regulate domestic media
05 = deny truth of knowledge from foreign sources
06 = restrict foreigners from speaking in country

(56) Restrictions on personal interaction with foreign persons or groups

01 = cultural exchanges
02 = travel restrictions
03 = participation in international nongovernmental conferences
04 = refuse collaboration on joint knowledge explorations
05 = restrict or expel foreign missionaries, educators, technicians

(57) Regulation on exchange of knowledge products with foreigners (physical products pertaining to knowledge including art work, inventions, or any physical commodity other than a news medium such as newspaper or magazine)

01 = technical assistance
02 = sell or purchase restrictions on knowledge products
03 = reject international conventions on copyrights and exchange of materials
04 = seize or prohibit foreign books, other materials
05 = black market activity in knowledge products

(58) Constraints on citizen advocacy of foreign ideas

01 = denouncement, arrest, trial and/or imprisonment for expressions of foreign ideas against the state; actions which government regards as "heresy"

(59) Constraints on failure to support educational and research activities

01 = agricultural programs
02 = art programs
03 = medical programs
04 = science and technology
05 = finance and economics
06 = trades and commerce
07 = law

(60) Private acts of physical abuse or violence against foreign ideas, those expressing them, or those using foreign knowledge products or associated with foreigners--or sharing domestic knowledge with foreigners

01 = destruction of books and libraries, communication facilities maintained by or contributed to country by foreigners
02 = mob or group action against fellow citizens with foreign ideas or transmitting ideas to foreigners

03 = private violent action against individuals for knowledge dissemination with foreigners

(61) Private nonviolent acts against foreign ideas or their advocates or transmission of domestic knowledge to foreigners

01 = nongovernment discrimination against those citizens identified with foreign ideas or transmitting ideas to foreigners
02 = economic boycotts, blacklists against foreign knowledge products, facilities or their users; or against those transmitting knowledge to foreigners
03 = demonstrations, strikes, protests against foreign knowledge products, facilities, or their users or against those transmitting knowledge to foreigners
04 = deny or revoke membership or affiliation in some organization

(62) Private statements of repudiation of foreign ideas or their advocates

01 = private denouncements of foreign ideas, knowledge products, etc.
02 = private reprimand to fellow citizens for their association with foreign ideas or transmitting knowledge to foreigners

(63) Private groups or individuals refuse to share their knowledge, expertise with others

01 = protest against policies of government and/or people
02 = experts avoid country for better economic incentives elsewhere

(64) State of cumulated knowledge

01 = knowledge capability lost from disaster, war, purge, etc.
02 = knowledge capability not yet developed

(65) Economic capability (unable to bear the cost of support knowledge facilities or products)

01 = basic education
02 = advanced or technical training
03 = research
04 = cultural enrichment

(66) Religious or ideological prohibitions (cultural, ethical, or ideological norms make ideas or products reprehensible or unbelievable)

01 = religious constraints
02 = political ideological constraints
03 = cultural experience constraints

The event data structure used[12] by Charles McClelland and his definition of relationships[13] provide a proven and existing structure for the development of a declarative knowledge hierarchy. This will provide the foundation of the knowledge base for this system (see Table 2). The knowledge base itself will be dynamic in nature changing as event data is collected. The source for the knowledge base will consist of multiple textual (in digital form) inputs consisting of news services, government message traffic and source material developed by governmental agencies, i.e., intelligence estimates, economic forecasts and diplomatic data.

6.3.4 File Server/Data Base. Another important part of an expert system is the data base. It is sometimes called a global data base because it contains a broad range of information about the current status of a problem being served. In practice, the data base is really a portion of working memory where current status of the problem-solving process is being stored. This is where textual event data would be stored and as new facts are gleaned from the inference process would be maintained.

One of the main problems with existing crisis system is the volume of data they must routinely handle. Limitation of storage devices, transfer speed in and out of data bases and the significant overhead associated with structured data base systems have all impeded the response time of existing systems. The result has been severe constraints on system capabilities and the tendency to maintain only current information in the system. This problem is substantially compounded when the data to be handled is textual. One area of major technical difficulty has been the computer-intensive activities associated with pattern matching and search. One technique used to circumvent this problem is to use inverted file structures which help solve the compute problem and introduces substantial

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12 WEIS Technical Report, University of Southern California, 1971

13 C. A. McClelland, Warning in the International Event Flow, Threat Recognition and Analysis Project Technical Report, University of Southern California, 1975

TABLE 2. KNOWLEDGE BASE

1. CONFLICT DEEDS

    11. Demonstrate

        111. Nonmilitary demonstrations, walk out on
        112. Armed force mobilization, exercise, and/or display

    12. Reduce relationship

        121. Cancel or postpone event
        122. Reduce routine international activity, recall officials
        123. Halt negotiations
        124. Break diplomatic relations

    13. Expel

        131. Order personnel out of country
        132. Expel organization or group

    14. Seize

        141. Seize position or position
        142. Detain or arrest person(s)

    15. Force

        151. Noninjury destructive act
        152. Nonmilitary injury/destruction
        153. Military engagement

2. CONFRONTATION

    21. Reject

        211. Turn down proposal, reject protest, demand threat
        212. Refuse, oppose, refuse to allow

    22. Accuse

        221. Charge, criticize, blame, disapprove
        222. Denounce, denigrate, abuse

    23. Protest

        231. Make informal complaint
        232. Formal complaint or protest

24. Deny

241. Deny an accusation
242. Deny an attributed policy, action, role, or policy

25. Demand

251. Issue order or command, insist, demand compliance

26. Warn

261. Give warning

27. Threaten

271. Threat without specific negative actions
272. Threat with specific negative actions
273. Threat with force specified
274. Ultimatum, threat with time limit and negative sanctions specified

3. ATTEMPTS TO SETTLE

31. Approve

311. Praise, hail, applaud, condolences
312. Endorse other policy or position, give verbal support

32. Consult

321. Meet with at a neutral site or send note
322. Visit, go to
323. Receive visit, host

33. Promise

331. Promise own policy support
332. Promise material support
333. Promise other future support
334. Assure, reassure

34. Request

341. Ask for information
342. Ask for policy assistance
343. Ask for material assistance
344. Request action, call for
345. Entreat, plead, appeal for

35. Purpose

351. Offer proposal
352. Urge or suggest action or policy

4. SETTLEMENT

41. Yield

412. Surrender, yield to order, submit to arrest
413. Yield position, retreat, evacuate
414. Admit wrongdoing, retract statement

42. Grant

421. Express regret, apologize
422. Give state invitation
423. Grant asylum
424. Grant privilege, diplomatic recognition, defacto relations
425. Suspend negative sanctions, truce
426. Release and/or return persons or property

43. Reward

431. Extend economic aid
432. Extend military assistance
433. Give other assistance

44. Agree

441. Make substantive agreement
442. Agree to future action or procedure, agree to meet, to negotiate

5. EXPRESSION

51. Comment

511. Explicit decline to comment
512. Comment on situation--pessimistic
513. Comment on situation--neutral
514. Comment on situation--optimistic
515. Explain policy or future position

increases in mass storage devices to support this indexing scheme. Essentially, it has been a continued tradeoff which has resulted in constraining the system abilities to handle the evergrowing input of international event activity.

In the last five to eight years, a new industry has grown within this country to address these kinds of problems, the development of custom chips, mostly VLSI, which are aimed at solving a particular processing problem. In the area of test search and pattern matching, a new concept has been developed which relies on brut force processing. The concept called stoic processing essentially lines up hundreds of these chips in a line (each containing a set of letters which define the search or pattern to be matched) and streams sequential text data through this pipeline to acquire matches. Where previous search speeds of 1 to 2 megabytes per second were considered fast, these devices work at 12 to 14 megabytes per second. When you marry this device with new disc controller technology and high density storage devices which can now support these speeds, you solve a number of major problems: 1. you can process vast quantities of data in relatively short times; 2. you can do historic searches to look at long-term trends/changes; 3. you can let the systems analyze all the data and only bring salient events to the attention of the analyst thereby reducing or eliminating information overload; 4. you do not need a data base management system with its costly overhead in terms of space or maintenance (i.e., store a days event by cylinder since you can process vast quantities of data so quickly); and 5. you have an incredible ad hoc capability available to the analyst to search the data base.

6.3.4 Measuring Uncertainty. One of the key strengths of expert systems is their ability to deal with incomplete or uncertain information. An expert system handles these ambiguities by qualifying the solution. Normally this is handled by attaching certainty factors to the rule sets (such as Dispersion factors in Table 3).

The traditional approach for analyzing international behavior has, as mentioned, been the application of algorithmic methods. Put plainly,

TABLE 3

	NUMBER OF PROBLEM AREAS SALIENT FOR NATION[a]	FOUR MOST SALIENT PROBLEM AREAS[b]	NUMBER OF PROBLEM AREAS WHICH NATION DOMINATES[c]	PROBLEM AREAS DOMINATED[d]	PROPORTION OF TOTAL PROBLEM AREAS WHICH NATION ADDRESSES (DISPERSION)[e]
BELGIUM	7	Regulations and Protective Actions (16%) Trade Agreements (9%) Fiscal Monetary Arrangements (7%) Advance Proposals (14%)	3	Regulations and Protective Actions (10%) Economic Assistance (4%) Transportation Distribution (4%)	.90
CANADA	7	War (6%) Trade Agreements (8%) Advance Proposals (8%) Need Diplomatic Communication (7%)	2	Economic Assistance (4%) Nongovernmental Opposition to Policies (9%)	.90
CHILE	9	Trade Agreements (9%) Economic Assistance (8%) Repudiate/Reject Policy (8%) Advance Proposals (9%)	2	Health Care (6%) Natural Disasters (13%)	.80
CHINA (PRC)	8	War (20%) Verbal Threats (9%) End Agreements (11%) Repudiate/Reject Policy (11%)	6	Domestic Use of Military (6%) War (12%) Verbal Threats (8%) Commodity Transaction (10%) End Agreements (9%) Economic Well-Being (13%)	.75
COSTA RICA	6	Verbal Threats (8%) Fiscal/Monetary Arrangements (6%) Economic Assistance (10%) Need for Diplomatic Communication (8%)	1	Natural Disasters (11%)	.85

	NUMBER OF PROBLEM AREAS SALIENT FOR NATION[a]	FOUR MOST SALIENT PROBLEM AREAS[b]	NUMBER OF PROBLEM AREAS WHICH NATION DOMINATES[c]	PROBLEM AREAS DOMINATED[d]	PROPORTION OF TOTAL PROBLEM AREAS WHICH NATION ADDRESSES (DISPERSION)[e]
CUBA	6	Foreign Isolated Military Incidents (9%) Verbal Threats (9%) Regulations and Protective Actions (8%) End Agreements (16%)	4	Foreign Isolated Military Incidents (9%) Agriculture (12%) End Agreements (9%) State of Knowledge (10%)	.85
CZECHOSLOVAKIA	6	Arms Control (7%) Repudiate/Reject Policy (12%) Trade Agreements (9%) Need Diplomatic Communication (8%)	0		.80
EAST GERMANY	5	Verbal Threats (6%) Trade Agreements (10% Repudiate/Reject Policy (23%) Need Diplomatic Communication (10%)	1	Embarrassing Incidents (13%)	.70
EGYPT	5	War (8%) Verbal Threats (7%) Repudiate/Reject Policy (13%) Need Diplomatic Communication (8%)	2	Domestic Violence (7%) Industry (5%)	.88
FRANCE	6	Trade Agreements (7%) Regulations and Protective Actions (10%) Advance Proposals (11%) Need Diplomatic Communication (10%)	18	Nonwar Use of Military Force (7%) Arms Control (5%) Trade Agreements (10%) Fiscal/Monetary Arrangements (9%)	1.00

	NUMBER OF PROBLEM AREAS SALIENT FOR NATION[a]	FOUR MOST SALIENT PROBLEM AREAS[b]	NUMBER OF PROBLEM AREAS WHICH NATION DOMINATES[c]	PROBLEM AREAS DOMINATED[d]	PROPORTION OF TOTAL PROBLEM AREAS WHICH NATION ADDRESSES (DISPERSION)[e]
FRANCE				Financial Conditions (10%) Regulations and Protective Actions (13%) Economic Assistance (6%) General Domestic Economic Conditions (6%) Industry (7%) Transportation and Distribution (4%) Acknowledge Error (10%) Advance Proposals (10%) Need Diplomatic Communication (9%) Poverty (17%) Restriction on Personal Interactions (14%) Constraints on Education and Research Activities (7%) State of Knowledge (10%) Inability to Support Knowledge Facilities (14%)	
GHANA	5	Economic Assistance (6%) Repudiate/Reject Policy (14%) Advance Proposals (10%) Discrimination (11%)	3	Domestic Use of Military Force (6%) Constraints on Political/ Legal Well-Being (5%) Discrimination (13%)	.85
GUINEA	6	War (7%) Repudiate/Reject Policy (15%) Advance Proposals (7%) Discrimination (10%)	2	Discrimination (9%) Inability to Support Knowledge Facilities (6%)	.80

	NUMBER OF PROBLEM AREAS SALIENT FOR NATION[a]	FOUR MOST SALIENT PROBLEM AREAS[b]	NUMBER OF PROBLEM AREAS WHICH NATION DOMINATES[c]	PROBLEM AREAS DOMINATED[d]	PROPORTION OF TOTAL PROBLEM AREAS WHICH NATION ADDRESSES (DISPERSION)[e]
ICELAND	9	Arms Control (6%) Economic Assistance (12%) Advance Proposals (9%) Need Diplomatic Communication (10%)	0		.75
INDIA	5	War (9%) Conflict Negotiation/ Settlement (11%) Force Maintenance (6%) Need Diplomatic Communication (8%)	10	Conflict Negotiation/ Settlement (14%) Force Maintenance (21%) Domestic Violence (7%) General Domestic Economic Conditions (6%) Natural Resources Problems (11%) Agriculture (8%) Industry (5%) Constraints on Political/ Legal Well-Being (5% Hunger (9%) State of Knowledge (10%)	.95
ISRAEL	7	Foreign Isolated Military Incidents (16%) Conflict Negotiation/ Settlement (11%) Verbal Threats (6%) Repudiate/Reject Policy (8%)	3	Conflict Negotiation/ Settlement (11%) Agriculture (8%) Victims of War (11%)	.92
ITALY	8	Arms Control (6%) Regulations and Protective Actions (14%) Advance Proposals (11%) Trade Agreements (9%)	2	Trade Agreements (6%) Constraints on Education and Research Activities (5%)	.92

	NUMBER OF PROBLEM AREAS SALIENT FOR NATION[a]	FOUR MOST SALIENT PROBLEM AREAS[b]	NUMBER OF PROBLEM AREAS WHICH NATION DOMINATES[c]	PROBLEM AREAS DOMINATED[d]	PROPORTION OF TOTAL PROBLEM AREAS WHICH NATION ADDRESSES (DISPERSION)[e]
IVORY COAST	7	Trade Agreements (6%) Economic Assistance (10%) Repudiate/Reject Policy (13%) Discrimination (8%)	0		.70
JAPAN	8	Trade Agreements (9%) Regulations and Protective Actions (10%) Economic Assistance (8%) Repudiate/Reject Policy (10%)	2	Nongovernmental Opposition to Policies (8%) Victims of War (7%)	.88
KENYA	8	Fiscal/Monetary Arrangements (8%) Economic Assistance (8%) Repudiate/Reject Policy (9%) Constraints on Political/ Legal Well-Being (8%) Discrimination (11%)	0		.70
LEBANON	6	Verbal Threats (6%) Economic Assistance (10%) Repudiate/Reject Policy (10%) Advance Proposals (10%)	0		.72
MEXICO	7	Arms Control (8%) Trade Agreements (9%) Economic Assistance (10%) Need Diplomatic Communication (11%)	0		.78

	NUMBER OF PROBLEM AREAS SALIENT FOR NATION[a]	FOUR MOST SALIENT PROBLEM AREAS[b]	NUMBER OF PROBLEM AREAS WHICH NATION DOMINATES[c]	PROBLEM AREAS DOMINATED[d]	PROPORTION OF TOTAL PROBLEM AREAS WHICH NATION ADDRESSES (DISPERSION)[e]
NEW ZEALAND	9	War (6%) Regulations and Protective Actions (8%) Economic Assistance (7%) Advance Proposals (10%)	0		.72
NORWAY	8	Military Alliances (7%) Regulations and Protective Actions (9%) Economic Assistance (10%) Need Diplomatic Communication (9%)	0		.78
PHILIPPINES	6	War (8%) Verbal Threats (6%) Economic Assistance (9%) Repudiate/Reject Policy (8%)	1	Health Care (6%)	.88
POLAND	9	Arms Control (9%) Verbal Threats (7%) Trade Agreements (12%) Need Diplomatic Communication (9%)	0		.75
SOVIET UNION	8	War (10%) Foreign Isolated Military Incidents (8%) Arms Control (10%) Repudiate/Reject Policy (14%)	18	Domestic Use of Military Force (9%) Nonwar Use of Military Force (12%) Foreign Isolated Military Incidents (20%) Conflict Negotiation/ Settlement (12%)	.92

	NUMBER OF PROBLEM AREAS SALIENT FOR NATION[a]	FOUR MOST SALIENT PROBLEM AREAS[b]	NUMBER OF PROBLEM AREAS WHICH NATION DOMINATES[c]	PROBLEM AREAS DOMINATED[d]	PROPORTION OF TOTAL PROBLEM AREAS WHICH NATION ADDRESSES (DISPERSION)[e]
SOVIET UNION				Arms Control (15%) Force Maintenance (15%) Verbal Threats (10%) Commodity Transaction (14%) Natural Resources Problems (7%) Acknowledge Error (10%) End Agreements (11%) Repudiate/Reject Policy (11%) Need Diplomatic Communication (7%) Constraints on Political/ Legal Well Being (6%) Victims of War (6% Restrictions on Personal Interactions (12%) Constraints on Education and Research Activities (7%) State of Knowledge (12%)	
SPAIN	7	Nonwar Use of Military Force (7%) Economic Assistance (10%) Repudiate/Reject Policy (10%) Advance Proposals (12%)	0		.82
SWITZERLAND	5	Trade Agreements (15%) Fiscal/Monetary Arrangements (24%) Regulations and Protective Actions (19%) Advance Proposals (11%)	0		.32

	NUMBER OF PROBLEM AREAS SALIENT FOR NATION[a]	FOUR MOST SALIENT PROBLEM AREAS[b]	NUMBER OF PROBLEM AREAS WHICH NATION DOMINATES[c]	PROBLEM AREAS DOMINATED[d]	PROPORTION OF TOTAL PROBLEM AREAS WHICH NATION ADDRESSES (DISPERSION)[e]
THAILAND	6	Verbal Threats (5%) Economic Assistance (11%) Repudiate/Reject Policy (8%) Need Diplomatic Communication (12%)	0		.72
TUNISIA	6	War (7%) Repudiate/Reject Policy (16%) Need Diplomatic Communication (7%) Discrimination (8%)	2	Transportation and Distribution (4%) Discrimination (9%)	.90
TURKEY	6	Military Alliances (9%) Economic Assistance (6%) Repudiate/Reject Policy (9%) Need Diplomatic Communication (9%)	5	Military Alliances (10%) Transportation and Distribution (4%) Hunger (9%) Natural Disasters (19%) Restrictions of Personal Interactions (12%)	.90
UGANDA	6	Fiscal/Monetary Arrangements (7%) Economic Assistance (10%) Repudiate/Reject Policy (15%) Discrimination (10%)	0		.70

	NUMBER OF PROBLEM AREAS SALIENT FOR NATION[a]	FOUR MOST SALIENT PROBLEM AREAS[b]	NUMBER OF PROBLEM AREAS WHICH NATION DOMINATES[c]	PROBLEM AREAS DOMINATED[d]	PROPORTION OF TOTAL PROBLEM AREAS WHICH NATION ADDRESSES (DISPERSION)[e]
UNITED STATES	7	Nonwar Use of Military Force (7%) War (12%) Arms Control (7%) Repudiate/Reject Policy (8%)	32	See note f	1.00
URUGUAY	7	Trade Agreements (87%) Regulations and Protective Actions (8%) Economic Assistance (10%) Repudiate/Reject Policy (11%)	0		.78
VENEZUELA	8	Foreign Isolated Military Incidents (5%) Trade Agreements (9%) Economic Assistance (8%) Repudiate/Reject Policy (8%)	0		.88
WEST GERMANY	8	Military Alliances (6%) Trade Agreements (9%) Regulations and Protective Actions (10%) Repudiate/Reject Policy (11%)	12	Military Alliances (14%) Force Maintenance (15%) Trade Agreements (9%) Fiscal/Monetary Arrangements (9%) Financial Conditions (12%) Regulations and Protective Actions (12%) General Domestic Economic Conditions (5%) Industry (5%)	.88

	NUMBER OF PROBLEM AREAS SALIENT FOR NATION[a]	FOUR MOST SALIENT PROBLEM AREAS[b]	NUMBER OF PROBLEM AREAS WHICH NATION DOMINATES[c]	PROBLEM AREAS DOMINATED[d]	PROPORTION OF TOTAL PROBLEM AREAS WHICH NATION ADDRESSES (DISPERSION)[e]
WEST GERMANY				Repudiate/Reject Policy (6%) Nongovernmental Opposition to Policies (9%) Constraints on Economic Well Being (11%) Poverty (13%)	
YUGOSLAVIA	8	Trade Agreements (6%) Economic Assistance (6%) End Agreements (7%) Repudiate/Reject Policy (12%) Need Diplomatic Communication (18%)	0		.85
ZAMBIA	10	Economic Assistance (5%) Repudiate/Reject Policy (9%) Advance Proposals (8%) Constraints on Political/ Legal Well Being (13%)	1	Transportation and Distribution (6%)	.60

a A salient problem area is one which involves more than 5% of a nation's events.

b The percentage of events in a problem are is listed in parentheses after the problem area.

c Figures here represent the number of problem areas in which a nation has among the highest three percentages of events concerned with that issues across all 38 nations. The percentages used in determining these figures were calculated by dividing the number of events in a problem area for a nation by the total number of events in that problem area across all the CREON countries.

d The percentage listed here following the problem area indicates the proportion of the total number of events in the problem area across all 38 nations that involved the dominant nation.

e The figures in this column represent what proportion of the 40 problems areas with 25 or more events in the CREON data set.

f The following are the eight problems areas in which the United States was not dominant during the decade: Domestic Use of Military Force, Conflict Negotiations/Settlement, Trade Agreements, Regulations and Protective Actions, Discrimination, Victims of War, Natural Disasters, and Constraints on Education and Research Activities. The United States accounted for 25% or more of the events in the following problem areas: Nonwar Use of Military Force, War Military Alliances, Domestic Violence, Nongovernmental Opposition to Policies, Embarrassing Incidents, Hunger, and Poverty.

What decade ?

this software cannot deal with incomplete information which essentially governs international relations and behavior. As the old cliche goes, garbage in . . . . This is where AI programs, particularly where expert systems, shine. When the inputs are ambiguous or completely missing, you can still get a solution to your problem. While the system may qualify the solution, at least you get an answer which can normally be put to practical use. We will rarely, if ever, have all the facts before making decisions in the international arena. Experts almost always work with incomplete or questionable information but that does not and cannot stop them from making a decision.

In this rule-based expert system, numerical factors, a number of which already exist, indicating the truth or probability of a premise or conclusion, are used as a measure of uncertainty.

It has been shown that in a high percentage of expert system rules, there will be no ambiguity or uncertainty. We will know with confidence what a particular event, category or state of events means. In those instances discrete rules can be written to determine the meaning and inform the user. If a rule cannot be developed to cover a particular or set of events, then special rules can be developed to deal with this problem. For example, this kind of rule might state that if a particular piece of information is not available, that certain action should be initiated by the system or the user to further explore the possibility of getting an answer. It goes without saying that the confidence factors for interpretation of event data should come from two sources: 1. the experts themselves, and 2. the results from the research done on international behavior. The CREON project was a significant step in developing certain types of uncertainty factors. Another research area which should be used and has provided a sound foundation for identifying changes in international behavior patterns, relates changing activity levels to tension and uncertainty factors.

Research done in the 1970's[14] demonstrated that monitoring the volume and type of events flowing between countries could be used to determine the likelihood of a crisis. The one- and two-way (volume) flow of events yield activity levels of two types: tension and uncertainty indicators. In this system a tension indicator would compare the total number of events in the knowledge base categories of settle and settlement (cooperative behavior events) with the total number of events in the conflict and confrontation categories (conflicting behavior events). McClelland demonstrated that comparing the total number of events in these categories for a given time period could be used by a crisis analyst as a confidence indicator of an impending crisis. The second indicator, uncertainty, compared the total number of events to empirical records and could be used to demonstrate inconsistent behavior which is normally associated with changes in national posture. Through his analysis of numerous previous crises, he showed that as event activity rose in relationship to normal levels, the likelihood of a crisis increased proportionally.

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14 C. A. McClelland, The Management and Analysis of International Event Data, September, 1971.
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7.0 CONCLUSION

In the dynamic environment of international relations and the time sensitivity of crisis management, new research and methods must be developed to support the identification and management of crises activities. While there has been a great deal of research on various aspects of international behavior, there has been little effort expended in validating crisis indicators much less integrating military, political, and economic events which provide the foundation of crisis formation.

The attempts that have been made, in the open literature available, have concentrated on algorithmic solutions based on 1960's technology. The use of mathematical formulas provides a sound approach for analyzing and forecasting activities which are discrete in nature and lend themselves to numerical measure. The utilization of this approach, while limited by technology in the past, is by itself inappropriate when handling event activities, which by their very nature are incomplete by themselves, vague, difficult to measure, and surrounded by uncertainty.

The advent of new technology designed to interpret the meaning of information has provided a mechanism which, if properly utilized, can provide the foundation for significant improvement in the identification and management of international crises. It is a well-known fact that it takes years of experience to develop people who are knowledgeable enough to serve as decision makers in the world of international relations and few people succeed in achieving the necessary level of expertise.

When these people reach this level, they are certainly not the ones who work in or manage crises centers where problems initially precipitate. However, by taking advantage of their expertise in developing a national crisis warning system, a significant improvement can be realized in identification and management. Other technology advances in the storage, manipulation, and interpretation of ever-increasing amounts of data necessitate the implementation of new tools to support our national crisis managers.

However, I add as a word of caution that these systems, despite their potential, take a great deal of time to develop and their design, development, and testing is a complex undertaking. Further, additional research in the areas of uncertainty factors and indicators is necessary prior to system design. The area that will remain as unresolved in developing this system will be that of intent which I will leave to my successor for a research topic.

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